Tools to Manage a Historic European Park

Using GIS and CAD in Poland

Paul Braun

Muskau Park is an important historical and cultural landscape on an international scale. Founded by the Saxonian Prince Herman Von Puckler in 1815, it incorporates nature, culture, and the human spirit in a picturesque setting. Puckler's numerous encounters with the philosophy and work of landscape architects such as Capability Brown, Humphrey Repton, and William Nash gave him the impetus to create a park worthy of today's current preservation efforts. Muskau Park is one of 15,000 historic palaces, gardens, and cemeteries throughout Poland. The Muskau Park GIS / CAD Project (MPGIS / CAD) was a tri-national project initiated to use Geographic Information System (GIS) and Computer Aided Design (CAD) technology to digitally inventory the parks elements, analyze changes in the park over the past 179 years, and demonstrate the usefulness of simulation techniques such as 3D viewshed analysis.

Muskau Park History

Puckler conceived and developed the park on land inherited from his grandfather, as well as that which he purchased with his own funds. His vision of Muskau Park included a town and village, areas for farming and industry, meadows, rivers, lakes, forests, gardens, an arboretum, and forest nurseries. The original intention was for the park to be a landscape that was constantly transforming and adapting. Unfortunately, by 1845, the intentions of Count Puckler exceeded his financial abilities and he was close to bankruptcy. He was forced to sell the property. The development of the park was then taken over by a series of ideological successors and owners. After World War II, the development of the park brutally came to a halt due to the division of the park by a national border.

Current State

The park currently consists of approximately 2,500 acres straddling the border of Poland and Germany 120 miles southwest of Poznan, Poland and 300 miles southeast of Berlin, Germany. The German half of the park contains the most architectural features, a small well-maintained natural area and a large urban area; while the Polish side contains forested areas (previously the pleasure grounds), cultivated fields, and the town of Łęknica. Generally, the Polish side has lost a great deal of its original character due to overgrown vegetation, building degradation, encroachment by towns and villages, yearly wear and tear, and the blossoming economic activity of a "border town market" where Germans cheaply shop.

International Cooperation

Muskau Park preservation efforts, including MPGIS / CAD, were carried out by an international committee made up of The Institute of Historic Preservation in Germany (Institut Fur Denkmalpflege) and The Center for the Preservation of Historic Landscapes (Osrodek Ochrony Zabytkowego Krajobrazu), Warsaw, Poland. In particular, MPGIS / CAD was carried out by the Polish working group and a United States Peace Corps volunteer working apart from his placement in a Polish national park.

What is CAD and GIS technology?

Most everyone has either heard of or had contact with computer-aided design (CAD) and geographic information system (GIS) technologies. Essentially, CAD uses graphic symbols to create computerized drawings. These drawings can then be easily updated, reproduced, and plotted at any desired scale. GIS takes this even further by attaching a database to the digital data. Thus, a polygon "layer" (i.e., tree stands or historic structures) can be stored as a combination of graphic features as well as a database which describes the polygons with information such as type, age, and health of trees or for historic structures age, owner, address, and construction materials. Once all desired "layers" exist (MPGIS / CAD had 12 such layers) queries can be made. A typical query to a GIS could be, "graphically show all historic structures which are older than 120 years, are on highly erodible soils, have 300-year-old oaks within a 200-meter radius of the structure, and can be seen from the hiking trail at a particular point".

Another query could be, "Since 1900, where has the town and village encroached upon the open landscape and what areas should be recommended as sensitive or non-sensitive to development". Keep in mind that queries can become very complex and that they are often made up of a series of smaller sequential processes.

The Muskau Park GIS/CAD Project (MPGIS/CAD)

To attain the mentioned level of query and analysis, the Polish working group laid out four phases for the project: needs assessment, data conversion and staff training, data processing, and analysis.

Project Design

Phase One—Needs Assessment

Phase one consisted of a needs assessment, software and hardware evaluations, and purchasing of selected hardware and software. Hardware selected and purchased consisted of an IBM compatible 486 pc computer, a 17" color monitor, a A0 digitizing tablet, an 8 pen plotter, and a 4 color paint jet printer. pcARC / INFO 3.4 D+ was chosen as the GIS package while AutoCad and LandCADD were chosen as the CAD packages. It became

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very clear that open discussions of what staff wanted to accomplish and what GIS and CAD technologies could offer were invaluable toward creating a clear, concise vision of what the goals of the project were. Staff education as to hardware and software limitations and the need for clear contract specifications (for subcontracted work such as document scanning) could have paid great dividends in the long run.

Phase Two—Data Conversion and Staff Training

After 300 work hours the Polish working group advanced from the most primitive level of CAD and GIS understanding to a point where, in a multi-lingual environment, staff received scanned basemap data from a private contractor, converted it to pcARC/INFO format, learned basic editing, display, and print functions in all three software products, and drafted a database design identifying 12 "layers" and their subsequent descriptive data for the park. Again, it was clear that team discussion during database design improved the future product usability as well as developed "buy-in" and understanding of the project among the group.

It was also important that the team recognized their accomplishments and began to believe in their abilities to manipulate hardware and software.

Phase Three—Data Processing

Time saved by scanning park base maps was virtually lost as the working group was forced to spend time deleting undesired graphic data, such as hatching, from the layers. The undesired data occurred because the team was not aware of the need for, and subsequently, did not provide the contractor with "clean" base maps for scanning nor did they correctly specify what they wanted. With this freedom, the contractor processed the scanned data in a CAD package and delivered it to the team. The contractor did not divide the drawings into thematic layers (i.e. contours, roads, vegetation, etc) which would have made importing to the GIS package quite simple. Instead, one drawing was simply color coded. Thus, the team was forced to import the entire CAD drawing into pcARC/INFO, make multiple copies of the drawing, and manually delete all unwanted features from each drawing (i.e. all data but soils from the soils layer or all data but roads from the transportation layer). Once edited and processed, the team coded descriptive data into the database for 7 of the 12 layers. The contour layer was converted from pcARC/INFO into LandCADD in order to create a digital terrain model to do viewshed analysis. Most importantly, all three software packages were employed interchangeably as the team began to see the strengths and weaknesses of each software package and the pertinent issues of transferring data between them.

Phase Four—Analysis

As with most automation projects, data analysis is by far the most interesting and complex part of the project. Unfortunately, as with many projects, the majority of time and money is eaten up by preparation, conversion, and data processing. This loss of potential stresses the need for an educated project manager who is aware of what should be produced by a contractor, possesses a clear vision of project goals, understands the range of hardware and software abilities, and encourages staff to use the technologies therefore retaining their knowledge gained from courses and seminars.

For MPGIS/CAD data inventory, hardcopy plots, and interpretive maps for seven finished layers were created for presentations and use in publications and brochures. Future analysis will include defining a viewshed in LandCADD, querying which landowners, vegetation, and nearest roads fall within or impede the viewshed; comparing all historical maps in pcARC/INFO to see landuse, landcover, and road network changes over time; overlaying, using in pcARC/INFO, all relevant layers to create a composite map showing environmental sensitivity, high stress areas, and value rankings to make policy decisions more data driven; and finally, scanning and storing historic black and white photographs and construction details. These scanned images will then be retrieved from a digital plan drawing and displayed on the screen showing historic and current views from a particular location.

Conclusions

The Center for the Preservation of Historic Landscapes, being one of the first cultural resource management institutions to use and integrate GIS and CAD computer technology in Central and Eastern Europe, has seen the potential of these technologies as well as the new troubles, problems, and complications that accompany them. MPGIS/CAD highlighted some issues that are directly applicable to work here in the United States. Team education to facilitate "buy-in" and to properly inform users, who can then ask insightful questions, is vital toward creating a vision of expected results. Secondly, there is constant need to stay focused on project goals and not be led astray by temptations to "experiment" with new tools. Employees should be encouraged to use computers to retain training skills and build confidence in their abilities. Finally, the combination of CAD and GIS technologies can create new insights by combining, collecting, and portraying data in an innovative manner. These insights can assist the cultural resource manager to make more informed policy decisions.

Paul Braun is a graduate student at the University of Arizona where he is studying the application of GIS and remote sensing to landscape planning.